# *Austrodaphnella yemenensis* new species (Gastropoda: Turridae) from Yemen, Red Sea, with notes on *A. alcestis* (Melvill, 1906)

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## ABSTRACT

The genus *Austrodaphnella* Laseron, 1954, previously known only from Australian waters, is here reported from the Arabian Peninsula. Two species occur: *A. yemenensis* new species, from Yemen, Southern Red Sea, and *A. alcestis* (Melvill, 1906) new combination, a deep water species known only from the Gulf of Oman. SEM photographs of both species are provided.

*Additional key words.* Indo-Pacific, new combination

## INTRODUCTION

This paper deals with the genus *Austrodaphnella* Laseron, 1954, formerly reported only from Australian waters, but here shown also to occur off the Arabian Peninsula. At least two species occur also in the Arabian region, namely *A. yemenensis* new species from Yemen, Southern Red Sea, and *A. alcestis* (Melvill, 1906) new combination, a deeper-water species from the Gulf of Oman.

*Austrodaphnella yemenensis* is presently known only from a few adult specimens and fragments which were dredged on the continental shelf of Yemen by the French oceanographic ship MARION DUFRESNE, within the frame of the European Community project RED SED '92 (Southern Red Sea and Gulf of Aden).

SEM micrographs of both species here discussed and a redescription of *A. alcestis* are given. Although the anatomies of its included species are unknown, the genus *Austrodaphnella* is here assigned to the subfamily Raphitominae in accordance with previous workers. The protoconch and teleoconch morphologies of both species here discussed are consistent with such allocation.

Under the cladistic classification of the superfamily Conoidea recently proposed by Taylor, Kantor and Sysoev (1993), the subfamily Daphnellinae (= Raphitominae), previously included in the family Turridae, is transferred to the Conidae. However, this proposed classification has recently been criticized by Rosenberg (1999), who demonstrated that their results cannot be adequately replicated. As a consequence, this paper still follows the traditional arrangement. Abbreviations used in the text are: a/l = ratio of aperture length to total shell length; b/l = ratio of shell breadth to total length; BMNH = The Natural History Museum, London; MZB = Museo di Zoologia dell' Università di Bologna.

## SYSTEMATICS

Family Turridae H. and A. Adams, 1853
Subfamily Raphitominae Bellardi, 1875
Genus *Austrodaphnella* Laseron, 1954

*Austrodaphnella* Laseron, 1954, p. 45; type species: *Austrodaphnella clathrata* Laseron, 1954, by original designation.

**Diagnosis:** Shell thin, very small to small (up to 10 mm in length), fusiform, superficially resembling genus *Daphnella*, but totally lacking fine interstitial axial riblets. Sculpture of axial ribs crossed by few widely spaced spiral ridges forming quadrangular interstices. Anal sinus subsutural and very slight. Protoconch multispiral to paucispiral, diagonally cancellate or with rows of spirally aligned granules.

**Range:** Red Sea, Gulf of Oman and Australian waters, from 9 to 256 m.

**Remarks:** Laseron (1954), in his revision of the New South Wales turrid fauna, erected the genus *Austrodaphnella* for a single species, namely *A. clathrata* dredged from off Pittwater. According to its describer, *Austrodaphnella* differs from the genus *Daphnella* Hinds, 1844 in possessing a fusiform shell with a dis-

tinctly produced, instead of ovate, base and a coarsely clathrate sculpture lacking fine interstitial axial riblets. Powell (1966: 124) regarded *Austrodaphnella* as a valid genus included within the Daphnellinae ( = Raphitominae), an opinion recently followed by Sysoev (1993).

Shuto (1983) described a second species, namely *Austrodaphnella torresensis*, based on few damaged shells dredged from off Murray Island, Torres Strait, Queensland. Shuto regarded the species as distinctive because of its peripheral angulation and commented (op. cit.: 24): "it is a problem whether it is included in *Austrodaphnella* Laseron, 1954 or it represents a new subgenus or genus". We have not examined the type series of *A. torresensis*, but its morphological features seem not distinctive enough to warrant a supraspecific distinction from *A. clathrata*.

In this paper, we regard the taxon *Austrodaphnella* as a valid genus on the basis of its teleoconch sculpture, which differs considerably from that of *Daphnella* Hinds, 1844, this latter being a widely distributed genus well represented in the tropics.

Species assigned to *Daphnella* bear dense and minute axial riblets crossed by spiral lirae. In some species the spiral lirae are numerous and nearly equally thin as the riblets forming a very fine reticulation (e.g., *Daphnella botanica* Hedley, 1918), but lirae may also be much fewer and stronger than axial elements (e.g., *Daphnella subula* (Reeve, 1843)), rendering a distinctly carinate aspect to the teleoconch whorls (e.g., *Daphnella sabrina* Melvill, 1906). Some other *Daphnella* species have distinct axial ribs on early teleoconch whorls, but this ornamentation becomes completely obsolete on the last whorl, where the axial sculpture is represented only by rather thin riblets that produce, at most, a slight beading at the intersections with the spiral lirae.

The genus *Austrodaphnella* has widely spaced axial ribs crossed by few spiral ridges, forming relatively broad, quadrangular interstices. The axial sculpture is well developed on all teleoconch whorls, and the minute riblets observed in *Daphnella* are totally lacking. In addition to the difference in sculpture, species assigned to *Austrodaphnella* have a well-produced and strongly excavated base rendering, the last whorl conspicuously more inflated than the penultimate one. This feature, in addition to the thin shell, the relatively few teleoconch whorls, and the very shallow anal sinus, may give the shell a somewhat juvenile appearance. This presumably led Laseron (1954), in his description of *Austrodaphnella clathrata*, to observe that "the type may not be quite mature". Melvill (1906: 78), probably due to the small size and the general appearance of the shell, also considered the described specimen of his *Daphnella (Pleurotomella) alcestis*, a species here assigned to *Austrodaphnella*, as probably immature. However, referring to other specimens of the species, he noted that "the six or eight examples that occurred were all much of the same size". The somewhat immature appearance noted for the two above-mentioned species is also present in *A. yemenensis*. Although determination of the adult state may be somewhat problematic in species lacking a terminal varix or swelling, it seems unlikely that all these species are actually based solely on juvenile specimens.

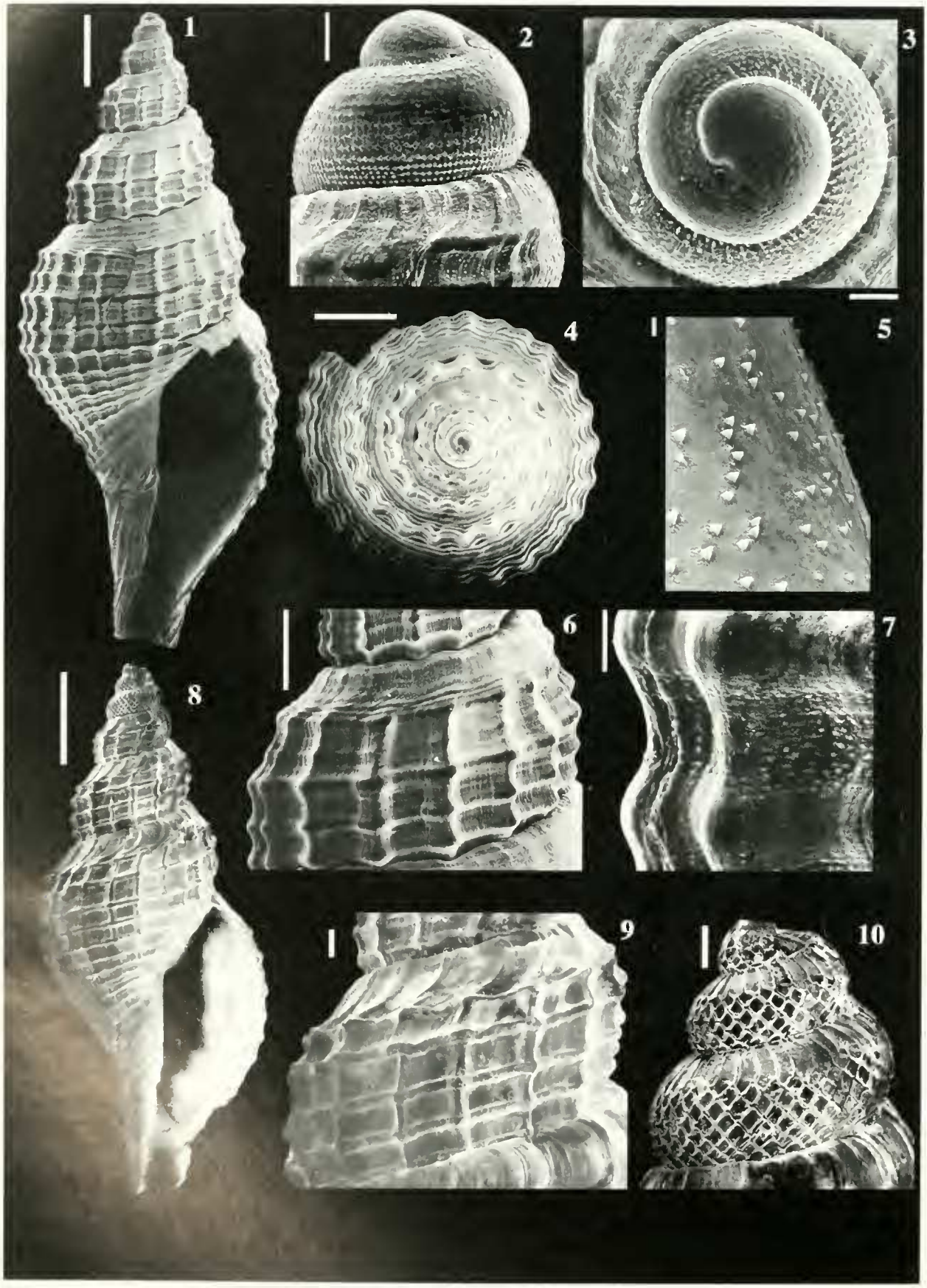
The genus *Daphnella* differs distinctly in this respect from *Austrodaphnella* in possessing a less produced and usually more shallowly excavated base, which gives the last whorl a more elongate-ovate shape. Furthermore, in many *Daphnella* species the anal sinus, though not necessarily deep, is nevertheless distinct; the species assigned to *Austrodaphnella*, as stated above, have a nearly imperceptible sinus. Whether these differences between the two taxa are of generic or subgeneric rank is a matter of opinion. However, the genus *Daphnella*, as presently construed, seems to represent an overcrowded and heterogeneous assessment of species ranging from the Eocene to Recent. Possibly, anatomical studies on some of these species might produce evidence allowing separation of *Daphnella* into different genera or subgenera. Examples of similar situations in other turrid groups are taxa such as *Crassispira* Swainson, 1840, and *Eucithara* Fischer, 1883, belonging respectively to the subfamilies Crassispirinae and the Mangeliinae. Both these two genera are currently accepted as composed by several different groups recognized on the basis of the shell morphology and/or radular features (see for example McLean, 1971; Kilburn, 1992). The taxon *Austrodaphnella* seems to represent a small but distinctive group of species possessing similar shell proportions and sculpture, and is probably worthy of recognition as a genus separate from *Daphnella*, even if its anatomical features are presently unknown.

Apart from *A. clathrata* Laseron, 1954 and *A. torresensis* Shuto, 1983, both from Australian waters, there are at least two other species from the Arabian Peninsula clearly referable to *Austrodaphnella*. One is hereunder described as *Austrodaphnella yemenensis* new species, the other, *A. alcestis* (Melvill, 1906) new combination, was dredged from off the Gulf of Oman and has never been recorded since.

*Austrodaphnella yemenensis* new species
(Figures 1–7)

**Diagnosis:** Shell up to 8.6 mm in length, last whorl with 21–25 axial ribs decussated by 4 main spiral ridges. Subsutural ramp and interstices between ridges with secondary sculpture. Protoconch paucispiral, with granular spiral threads.

**Description:** Shell with a slightly cyrtoconoid spire, teleoconch consisting of 4.2 rapidly expanding whorls with strongly impressed suture. Whorls profile weakly shouldered. Subsutural ramp narrow and weakly concave, sculptured by 6–7 (on last two whorls) very low spiral threads and very fine axial incremental lines. Aperture oblanceolate, gradually tapering to siphonal canal. Siphonal canal moderately wide, lacking a terminal notch. Outer lip rather thin, not preceded by a labial varix and smooth inside. Columella rather long and gent-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ly convex. Parietal region slightly convex. Labial callus a thin glaze. SEM examination shows surface of inner lip covered with microscopic, sparse, somewhat squamiform granules (figure 5). Anal sinus reversed, L-shaped. Stromboid notch absent. Sculpture consisting of narrow, slightly angular axial ribs crossed by widely spaced spiral ridges to form spirally elongate interstices. Axial ribs orthocline, nearly equal in width to intervals or about half their width, obsolete on subsutural ramp, fading on last whorl at level of upper part of columella. There are 18 axial ribs on penultimate whorl, increasing to 21–25 on last whorl. First teleoconch whorl with 3 spiral ridges, subsequent whorl with 3–4 main spiral ridges. The first ridge, at the lower edge of the subsutural ramp, is double-spaced from the remaining ones. On later two teleoconch whorls, an additional weak ridge is observed in the interstice between the first and second ridge. Interstices between spiral ridges with 3–5 (on last two whorls) very low spiral threads. Interstices between spiral threads with a microscopic sculpture of spirally aligned granules (figure 7). Base with 14–15 ridges, those on rostrum long and nearly vertical; interstices between ridges with 1–2 very low threads on posterior part of base, anterior part devoid of secondary elements. Background color from light yellow to tan, with irregular orange blotches on last two whorls. Protoconch papilliform consisting of 1.8 whorls with impressed suture, sculptured by minute spiral threads crossed by finer axial threads to form rows of spirally aligned, minute granules (approximately 16 on last whorl of the holotype). Protoconch diameter 0.41–0.43 mm.

**Measurements (in mm):** Holotype: Length 8.6, width 3.3, aperture 4.5, b/l 0.38, a/l 0.52; paratype 1: length 8.5, width 3.7, aperture 4.6, b/l 0.43, a/l 0.54.

**Type material:** Holotype, MZB 17001; Paratype 1, MZB 17002; Paratypes 2–3 MZB 17003. Paratypes 2–3 are fragments lacking the body whorl.

**Type locality:** Off Yemen, southern Red Sea, 14°46′72″ N, 42°32′82″ E, 76 m depth on muddy sand.

**Etymology:** The specific name refers to the country where the new species was dredged.

**Remarks:** This new species is assigned to genus *Austrodaphnella* Laseron, 1954, on the basis of its teleoconch features. *Austrodaphnella yemenensis* is readily separable from its congeners by its short, papilliform protoconch with rows of spirally aligned granules instead of conical and with the typical diagonally cancellate sculpture. The protoconch morphology of the new species may resemble that of the widely distributed Indo-Pacific genus *Encyclotoma* Boettger, 1895. However, members of the latter genus differ from species of *Austrodaphnella* in possessing strong spiral keels on the teleoconch whorls. Furthermore, species assigned to *Encyclotoma* have a truncated anterior end, a distinct though not exceedingly deep anal sinus, and dense axial interstitial riblets closely resembling in this character species assigned to genus *Daphnella*.

Apart from the protoconch, *A. yemenensis* differs from *A. clathrata* Laseron, 1954, which is of comparable size being only slightly larger (10 × 4.5 mm according to Laseron, 1954) and has similar general shell proportions, in having three rather than two spiral ridges on early whorls and, judging from the original figure (op. cit.: 45, fig. 228), less beaded spiral ridges.

*Austrodaphnella alcestis* (Melvill, 1906), new combination
(Figures 8–10)

*Daphnella (Pleurotomella) alcestis* Melvill, 1906: 78, pl. 8, fig. 23.
*Pleurotomella alcestis* Melvill, 1917: 196.

**Diagnosis:** Shell of 5.4 mm in length, last whorl with 27 axial ribs decussated by 5 spiral ridges. Subsutural ramp with arched wrinkles, interstices between spiral ridges lacking secondary sculpture. Protoconch multispiral, diagonally cancellate.

**Description (BMNH specimen):** Shell with slightly cyrtoconoid spire, teleoconch consisting of about 3 rapidly expanding whorls with impressed suture. Whorls convex, weakly shouldered. Subsutural ramp narrow and weakly concave. Aperture oblanceolate gradually tapering to siphonal canal. Siphonal canal moderately wide, lacking terminal notch. Outer lip very thin, not preceded by labial varix and smooth within. Columella rather long and evenly convex. Parietal region convex. Labial callus a thin glaze. Anal sinus very shallow and broadly U-shaped. Stromboid notch absent. Sculpture consisting of narrow, slightly angular axial ribs crossed by wide-set, spiral ridges to form distinctly quadrangular interstices. Axials orthocline much narrower than intervals between them, forming strongly arched wrinkles on subsutural ramp, evanescing on last whorl at the adapical part of columella. There are 17 axial ribs on penultimate whorl; this number increases to 27 on last whorl. First teleoconch whorl with 4 spiral ridges, the first and weaker just below subsutural ramp. Penultimate whorl with 4

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**Figures 1–10.** Species of *Austrodaphnella*. **1–7.** Holotype of *Austrodaphnella yemenensis* new species, MZB 17001. **1.** Apertural view. Scale bar = 1 mm. **2–3.** Protoconch; scale bar 100 µm. **4.** Apical view. Scale bar = 1 mm. **5.** Squamiform granules of the inner lip. Scale bar = 10 µm. **6.** Teleoconch whorl. Scale bar = 500 µm. **7.** Microsculpture of teleoconch. Scale bar = 50 µm. **8–10.** Lectotype of *Austrodaphnella alcestis* (Melvill, 1906), new combination. **8.** Lectotype of *Daphnella (Pleurotomella) alcestis* Melvill, 1906, BMNH 1906.10.23.28–9. Scale bar = 1 mm. **9.** Teleoconch. Scale bar = 100 µm. **10.** Protoconch. Scale bar = 100 µm.

ridges and a fine thread at abapical suture. Last whorl with 5 spiral ridges. Base of last whorl with about 16 ridges (those on rostrum nearly faded). Color dull white. Protoconch conical, 0.67 mm diameter, with more than 3 whorls (tip missing) and diagonally cancellate sculpture.

**Measurements (in mm):** Length 5.4, width 2.3, aperture 3.0, l/l 0.43, a/l 0.56.

**Type locality:** Gulf of Oman, 24°58′ N, 56°54′ E, 285 m.

**Material examined:** Two specimens labelled as syntypes stored in BMNH (reg. no. 1906.10.23.28–9). Of these, one agrees with the original description, the other is very different, possibly a specimen of *Clathurella amphiblestrum* Melvill, 1904. The specimen of *Daphnella* (*Pleurotomella*) *alcestis* is here selected as lectotype. The SEM micrographs were taken with the specimen uncoated.

**Remarks:** This species was originally introduced as *Daphnella* (*Pleurotomella*) *alcestis* Melvill 1906, and compared with *Daphnella lucasi* Melvill, 1904, and *Clathurella amphiblestrum* Melvill, 1904, both from the Gulf of Oman. However, neither of these taxa is actually closely related to the species here discussed, which seems properly assigned to the genus *Austrodaphnella*. *Austrodaphnella alcestis* is readily distinguishable from *A. yemenensis* by its typical diagonally cancellate protoconch sculpture instead of rows of spirally aligned granules. Furthermore, *Austrodaphnella alcestis* (Melvill, 1906) is much smaller (5.4 mm vs. 8.6 mm in length), and lacks the secondary sculpture of spiral threads in the interstices between main ridges. In addition, *A. alcestis* has a dull white shell lacking the orange blotches observed in all the available specimens of *A. yemenensis*. It is comparable with *A. torresensis* Shuto, 1983 in dimensions but differs distinctly from the latter in its convex whorls lacking the peripheral angulation of the Australian species. *Austrodaphnella clathrata* is much larger than *A. alcestis* (10 × 4.5 mm vs 5.4 × 2.3 mm) and has two instead of four spiral ridges on early teleoconch whorls.

**Biogeographic remarks:** The presence of a genus originally described from the Southern Hemisphere in the Arabian Region may probably be explained considering the effect of the Arabian Sea upwelling. During summer the coastlines of Yemen and Oman are affected by the strong Southwest Monsoon, which blows warm surface water offshore causing its replacement by deep, colder oceanic water. Sheppard et al. (1992) discussed some of the more significant consequences that derive from this event. Among other effects, strong upwelling in tropical regions inhibits coral reef growth and induces the development of macroalgal communities of a temperate rather than tropical nature. Thus, the occurrence in the Arabian Sea of species of *Ecklonia*, a kelp genus otherwise found only in the southern hemisphere (Australia, New Zealand and South Africa), is recognized as probably resulting from the lower water temperatures and nutrient input associated with upwelling. The authors also suggested the possibility that the cold upwelling water, by inhibiting reef growth, may act as an ecological barrier restricting the recruitment of many tropical groups in the Red Sea and the Persian Gulf. It seems possible that larvae of species of *Austrodaphnella* may have found in the Arabian Peninsula environmental conditions favorable to metamorphosis. Sheppard et al. (1992) also noted that the upwelling effects may also be strong along the Somali coastline. A possible example supporting this view is the occurrence off Mogadiscio of *Pseudexomilus fuscoapicatus* Morassi, 1997, a species belonging to a genus known otherwise only from South Africa, southern, and eastern Australia.

*Austrodaphnella yemenensis* differs from all others species assigned to the genus *Austrodaphnella* in protoconch morphology (paucispiral instead of multispiral). This difference is generally regarded as indicative of two different types of developmental strategies, i. e., non-planktotrophic *versus* planktotrophic development. However, it is generally agreed that different types of larval dispersal may develop in species of the same genus, so that a species with a paucispiral protoconch does not necessitate inclusion in a genus separate from that including species with multispiral protoconchs (Bouchet, 1990).

A number of environmental factors associated both to geographic and climatic factors (such for example geographic isolations, temperature changes, enstatic, and salinity changes), may act in promoting loss of planktotrophy. Planktotrophic species have a prolonged larval life and are therefore more exposed to physical and biological factors increasing larval mortality rates (Rumrill, 1990). Acquisition of lecithotrophic or "direct" larval development may therefore be an ecological adaptation favorably selected in relatively hostile environments characterized by climatic fluctuations (Oliverio, 1996). The dramatic climatic changes in the Arabian Peninsula that particularly affected the Red Sea and the Gulf of Aden during the Quaternary, and the continued strong seasonal temperature fluctuations related to upwelling conditions are factors that probably induced, and may still be inducing, non-planktotrophic larval development.

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